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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/802,563	03/17/2004	Hong Yu Yu	NUS03-001	3494

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EXAMINER	
KIM, SU C	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 10/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/802,563	YU ET AL.	
	Examiner	Art Unit	
	Su C. Kim	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8-15,24-27 and 35-59* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-12,14,15,24-27,35-37,39-44,46-49 and 51-59* is/are rejected.

7)☒ Claim(s) *13,38,45,50 and 57* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

1. The indicated allowability of claims 8-15, 24-27, & 35-59 are withdrawn in view of the newly discovered reference(s) to Haukka et al. (US 6858524). Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 8, 9, 14, 24, 26, 27, 35, 36, 37, 40, 41, 42, 48, 49, 51, 53 ,& 58 are rejected under 35 U.S.C. 102(e) as being anticipated by Haukka et al.(US 6858524) Pertaining claims 8, 24, 35, & 40, Haukka discloses providing a dielectric layer (Fig. 1B, gate dielectric 110) on substrate;

depositing a hafnium nitride layer(Fig. 1b column 4, lines 58-59, 112 overlaying said dielectric layer;

depositing a capping layer(Fig. 1b, column 5, line 2, tantalum nitride or tungsten (W)) overlaying said hafnium nitride layer;

patterning said hafnium nitride layer and said capping layer and said dielectric layer to from CMOS gate electrode (Fig.1b, elements 114,112,119,109 are patterned);

and forming source and drain (Fig. 1b. 103, 102) within substrate adjacent to CMOS gate electrode (Fig.1b, elements 114,112,119,109)

Pertaining claims 9, 36, 49, & 53 as applied to claims 8, 35,48, & 24 above, Haukka discloses all the limitations include, depositing hafnium nitride layer comprising flowing Nitrogen and Argon (column 6, lines 14) atoms into a chamber simultaneously

Pertaining claims 14, 39, 51, & 58, as applied to claims 8, 35, 49, & 53 above, Haukka discloses impurity doping into said hanium nitride layer (column 8, lines 52-62, metal nitride layer is treated with hydrogen plasma) to tune the work-function of said gate electrodes.

Pertaining claims 26 & 48, as applied to claims 24 & 40 above, Haukka discloses all the limitations include, first metal layer comprises hafnium nitride (column 4, lines 60) and second metal comprises tungsten or tantalum nitride (Column 5, lines 1-2)

Pertaining claims 27, & 42, as applied to claims 24 & 40 above, the first and second metal layers are deposited by CVD or PVD (column 8 lines 65)

Pertaining claims 37, & 41, as applied to claims 35 & 40 above, Haukka discloses all the limitations include, dielectric layer comprises HfO2 (column 5, lines 7-17)

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 10, 15, 52, 54, & 59 rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al.(US 6858524)

Pertaining claims 10, & 54, as applied to claims 9, & 53 above paragraph 3, Haukka discloses all the limitations include, argon and nitrogen gas but fails to teach flow rates are kept as constant at 25sccm and 5 sccm.

Notwithstanding, one of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Pertaining claims 15, 52, & 59, as applied to claims 8, 49, & 53 above paragraph 3, Haukka discloses thermal treatment of hafnium nitride layer by RTA (Column 8, lines 56-59) at about 1000°C for about 20 second

Notwithstanding, one of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not

disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

6. Claim 11, & 55 rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al.(US 6858524) in view of Metzner et al. (US 20030232506)

Pertaining claims 11, & 55, as applied to claims 8, & 24 above paragraph 3, Hakkua discloses dielectric layer comprises HfO2 (Fig. 1b, 110 HfO2)

However, Hakkua fails to teach HfO2 is deposited at 400 °C using MOCVD cluster tool.

Metzner discloses HfO2 is deposited by using MOCVD cluster tool (paragraph 0056)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention is made to provide Haukka with depositing HfO2 by using MOCVD taught by Metzner in order to produce suitable method to deposit HfO2.

7. Claims 12, & 56 is rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al.(US 6858524) in view of Chen (US 20050269651)

Pertaining claims 12, & 56, as applied to claims 8, & 24 above paragraph 3, Haukka discloses all the limitations include, dielectric layer comprises HfO2 However, Haukka fails to teach dielectric layer is subjected to Post-depositiong annealing at 700 oC in a N2 ambinet.

Chen discloses HfO2 is subjected to Post-depositiong annealing in a N2 ambinet(paragraph 133)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention is made to Haukka reference with HfO2 is subjected to Post-depositing annealing in a N2 ambient taught by Chen in order to produce suitable method to deposit HfO2.

Notwithstanding, one of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*,

725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

8. Claims 25, 43, 44, 46 & 47, are rejected under 35 U.S.C. 103(a) as being unpatentable over Haukka et al.(US 6858524) in view of Li (US 20050167764)

Pertaining claims 25 & 43, as applied to claims 24 & 40 above paragraph 3, Haukku discloses all the limitations include, first metal is tungsten or tantalum nitride (column 4, lines 60, $TaSi_xN_y$)

However, Haukku fails to teach the second metal is hafnium nitride.

Li suggests hafnium nitride is gate electrode. (paragraph 0035, Fig. 7, 210)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention is made to provide Haukku with hafnium nitride as gate electrode taught by Li in order to produce better device.

Pertaining claim 44, as applied to claim 43 above paragraph 8, Haukka and Li in combination disclose all the limitations includes, depositing hafnium nitride layer comprising flowing Nitrogen and Argon (Haukka, column 6, lines 14) atoms into a chamber simultaneously

Pertaining claim 46, as applied to claim 44 above paragraph 8, Haukka and Li in combination disclose impurity doping into said hanium nitride layer (column 8, lines 52-62, metal nitride layer is treated with hydrogen plasma) to tune the work-function of said gate electrodes.

Pertaining claim 47, as applied to claim 44 above paragraph 8, Haukka and Li in combination disclose thermal treatment of hafnium nitride layer by RTA (Column 8, lines 56-59) at about 1000oC for about 20 second

Notwithstanding, one of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Allowable Subject Matter

9. Claims 13, 38, 45, 50, & 57 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Su C. Kim whose telephone number is (571) 272-5972. The examiner can normally be reached on Monday - Thursday, 9:00AM to 7:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Brook Kebede

BROOK KEBEDE
PRIMARY EXAMINER

Su C. Kim
9/30/2006